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EXTENT OF MINERALIZATION ORGANIC FERTILIZER ON SALT AFFECTED SOIL AND THAT IMPLEMENTATION ON TOMATO

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ABSTRACT

Mineralization of organic fertilizers in saline soil is determined by the level of soil salinity. The higher levels of soil salinity, the lower the ability of organic matter mineralization. Evaluation mineralization levels assessed by the content of N, P, K, C-org in organic fertilizer. Research objectives were to assess the ability of the various formulas of mineralization of organic fertilizer to provide nutrients and suppress soil salinity. Nutritional NPK fertilizers are classified by grade. The results showed that the formula with high-grade organic fertilizer was obtained from a mixture of manure, compost, guano, and straw. High-grade organic fertilizer is not always effective as the controlling soil salinity and aggregate stability, but can increase the CEC and the availability of N, N-ammonium inhibits volatilization, decrese soil EC, but soil pH was increased. Mineralization rate of organic fertilizer on clay-textured soil (Rungkut and Sedati) more slowly than sandy soil (Buduran).

Keywords: grade, mineralization, NPK, organic fertilizers, soil salinity,

INTRODUCTION

Decomposition is the process of metabolic degradation of organic matter into simple organic and inorganic compounds. Three major processes are generally involved in terrestrial decomposition: leaching, fragmentation, and chemical alteration. Mineralization is the conversion of nutrients and other substances from an organically bound form to a water-soluble inorganic form. Decomposition and mineralization are closely related processes; mineralization is often considered as a subset of decomposition, while decomposition does not always lead to mineralization. Decomposition is generally associated with the carbon cycle whereas mineralization contributes to nutrient cycling (Wang and DõOdorico, 2008). The speed of decomposition of organic material is influenced by the conditions of salinity (chemical), aerobic condition (physical) , and textural properties of a soil (Barzegar, and Oades, 1997; Krull, Baldock and Skjemstad. 2001; Qadir, et al. 2007). The relative loss of added C differed between soils and its magnitude depended on the decomposable characteristics of the added organic materials, with chicken manure Omungbean residueOwheat residue (Khalila, Hossaina, Schmidhalter. 2005). Decomposition rate is slower in the flooded areas than that are not flooded, and the open areas more quickly than the original. Decomposition Effect on straw added to soil apparent after 67 days of incubation, the loss of C through mineralization greater in the type-clay kaolinitic than smectit -Illit, possibly due to greater protection of clay and a larger surface type. On the other hand loss of C higher in low-level sodixitas, this is likely due to anaerobic conditions or protection by the dispersion of clay particles. The presence of multivalent cations such as Ca (as Ca-containing minerals or exchangeable cation), leads to accumulations of organic C in comparison to other soil types. Stabilization of OC in high base status soils with less reactive CaCO3 must result primarily from the formation of Ca-organic linkages. The correlation between mineralization and sodicity influenced by Na, Ca on organic molecules and type of clay also affects biological activity either directly or indirectly (Baldock and Skjemstad , 2000). The high pH and high concentrations of monovalent cations decreased formation of solid organo-mineral complexes. the salt-affected soils oxidatively altered organic compounds are susceptible to losses in dissolved or colloidal forms, because these compounds are not stabilized against leaching and mineralization by chemical bonding to soil (Peinemann, Guggenberger and Zech. (2005). The degree and amount of protection offered by each mechanism depends on the chemical and physical properties of the mineral matrix and the morphology and chemical structure of the organic matter. Each mineral matrix will have a unique and finite capacity to stabilise organic matter (Baldock and Skjemstad, 2000). The salt-affected soils oxidatively altered organic compounds are susceptible to losses in dissolved or colloidal forms, because of these are not stabilized against leaching and mineralization by chemical bonding to soil minerals **(**Peinemann , Guggenberger and Zech, 2005)**.**

Some organic amendments can improve chemical fertility and biological activity (Tejada et al. 2006; Clark, et al. 2007; Qadir, et al. 2007; David, Walker and Bernal, 2008; Yousif and Abdalla, 2009). Compost that produced from mixture by-products of the olive oil industry and a poultry manure on mineral ion solubility and exchangeability in a highly saline agricultural soil (EC, 1:5 soil:water extract = 1.85 dS m^{-1}) did not change significantly the soil EC or the soluble Na^+, Ca^{2+} or Mg^{2+}. Only soluble K^+ increased, due to the K^+ supplied by the amendments. The cation exchange capacity increased in treated soils, the exchange complex being mainly saturated with Ca^{2+}, Mg^{2+} and K^+. But, Na^+ was not retained in the exchange sites, and the sodium absorption ratio remained low. Organic wastes added had a positive effect on the physical, chemical and

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biological properties of the soil Compost and manure increased markedly the shoot growth, K^+ and $H_2PO_4^-$ of the salt-tolerant plant, decreases in the shoot concentrations of Na^+ and Cl^- (Monitoring mineral N release during decomposition of manures is **a** useful tool for fertilization programs that include incorporation of organic sources of N from various manures. Soil amelioration to Sodic and alkali primarily involves increasing calcium (Ca^{2+}) on the cation exchange complex at the expense of Na^+. Amelioration of thtah soils can be accomplished through several methods, sitespecific method depends on several soil properties and other considerations (depth of soil to be ameliorated, presence of compacted layers in subsoil, content and type of salts present, composition and quantity of water available for leaching, quality and depth of groundwater, desired rate of replacement of excessive exchangeable Na+, occurrence of lime or gypsum in soil, content and mineralogy of clay fraction, availability and cost of amendments, topographic features of the land, nature of the crops to be grown or the land use during and after amelioration, climatic conditions, and time available for amelioration. Adequate water application and soil drainage with deep groundwater are essential prerequisites for sustainable amelioration.

The physical properties of soil are foremost influenced by the organic material is the stability of aggregates Aggregate soil microbial community is a product, the organic material and mineral components, plant communities on the ground, and the history of the ecosystem. They are important in the storage and movement of ground water and in soil aeration, erosion, root development and activity of microbial communities. Aggregate stability is usually influenced by the BO, clays, oxides, calcium carbonate, and Na-exchangeable. Aggregate stability increases with increasing organic matter content (as long as BO <2%), the amount of clay soil, the surface area of clay and iron oxide content is free. The content of calcium carbonate and exchangeable -Na > 20% usually does not affect the stability of aggregate real. If the content of soil organic matter 2% and 10% of clay, the appropriate aggregate stability ranged between 65 -75%. Barzegar et al. (1997) found that crop residues have a positive influence on the stability of soil aggregates in water and occur at low ESP and high organic matter.

Drying-rewetting cycles decreased mineralisation and microbial biomass C but did not influence the effects of sodicity and salinity (Nelson, Ladd and Oades. 1999). The presence of clay particles in soil provides the most significant surface area onto which OC may be adsorbed (Krull, et al. 2001).

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This study aims to assess mineralisation of organic fertilizer that made from various local organic matter on difeerent salin soil and its impact on tomato nutrient availability and growth.

MATERIALS AND METHOD

Experiment and data collection

The experiments were conducted in a Soil laboratory on Agriculture of Faculty UPN ñVeteranò Easr Java. The raw material of organic fertilizers include cow manure (M), leaf compost (Co), sawdust (Sd), straw (S), deposition of marine mud (M) (was obtained from Surabaya and Sidoarjo), Guano (G), and cotton seed (Cs), was obtained from Gresik. Each of organic material sub-samples air dried and sieved with a 2 mm sieve for analysis of total organic-C (Walkey and Black), N-total (Mikrokjeldahl, P-available (Bray-1), and exchangeable bases of-K, -Ca, and -Mg (NH4Oac 1N), EC and pH of soil pasta (1:1, w:s). The results of measurements of levels of NPK fertilizer element used to classify the grade of fertilizer. Each sample of organic matter weighed 1 kg and then mixed evenly between materials with proportion 1:1 with minus ones kinds of matterial, resulting seven mixture organic fertilizer (Table 1). Organic fertilizer that have high levels of NPK analysis (grade) electivity tested on saline soil and tomato growth.

Soil samples taken from Rungkut, Sedati, and Buduran, air dried and sieved with a 2 mm sieve. Soil samples were weighed 2 kg equivalent to absolute dry weight (ADW) was mixed with 40 grams (20 tons/ha) of organic fertilizer and put into the pot capacity 2 kg, were incubated at field capacity moisture content and room temperature for 2 weeks. Prior to application of organic fertilizers, soil saline given at a dose corresponding Gypsum to 2.25, 4.50, and 8.5 tones / ha, equivalent to 1.125; 2. 25 and 4.25 g/kg, respectively to Saline Soil from Rungkut, Sedati and Buduran. After that, each sub-sample of soil treatment approximately 10 g taken for analysis of total organic-C levels, available NPK and soil pH. Organic fertilizer makes from a mixture of manure (cow and goat) and leaf compost with a ratio of 1:1. After incubation, the basic NPK fertilizer added equivalent to 200 kg/ha.

Table 1. Combination Treatment of Organic Fertilizer

No.	Treatment	Rungkut + 8.5 t gypsum / ha	Sedati+ 4.5 tons gypsum / ha	Buduran + 2.5 tons gypsum / ha	NPK - OF(%)
1.	Control	R-Control	S-Control	B-Control	
2.	NPK	R-NPK	S- NPK	B-NPK	
3.	OF1 Complete (C)	R-OF1	B-OF1	S-OF1	5.53
4	OF2 (C- M)	R OF2	B OF2	S OF2	5.37
5.	OF3 (C- (G+M)	R OF 3	B OF 3	S OF 3	4.26
6	OF4 (C-(G+M+S)	R OF 4	B OF 4	S OF 4	3.90
7	OF5 (C-(G+M+S+ Sd)	R OF 5	B OF 5	S OF 5	3.85

Tomato responses to soil salinity changes

Greenhouse experiments were conducted at the Faculty of Agriculture, University of Pembangunan Nasional "Veteran" East Java, in March until June 2007. The experiments are arranged in completely randomized factorial design, where the first factor was 3 saline soil from Rungkut, Sedati, Buduran and the second factor was 7 fertilizer treatments: control, NPK, and 5 fertilizer selected: OF complete =C =(Ma, C, Cs, Sd, S, G, Mu), C- M; C- (M+ G;) C-(M + G + S), and C-(M + G + S +CS). Combination treatment means presented in Table 1. Each treatment combination in duplicate for analysis of soil salinity, organic C, total N, available ï P and exchangeable-K.

Seed tomato is planted in soil mixed media, gypsum and fertilizer selected two seeds per pot and given a light irrigation water (ECw <1) up to field capacity. After a 2-weeks-old planted, thinned to a spacing 1 plant per pot to maintain its growth until35 days after planting. Pest control carried out if found to be a symptom of pest attack. Preventive action is performed by mechanical means using a pesticide spraying. Harvesting is done on old plants 35 days after planting (DAP) and uptake of N, P, K, plant tissue tested as well as fresh weight and the weight of the roots of plants.

Data Analysis:

Results of organic matter -N, -P, and -K analysis are used to diagnosing grade of them. Average of soil -pH, -EC, exchangable-Na, and C-organic content analysis evaluated after gypsum and organic metter applications. Data analysis included ANOVA of seven level organic fertilizer and 3 salin soil . Further test results by LSD 0.05 Anova conducted to determine the level of tolerance of maize in variable ECw. Relationships patterns of two variables were analyzed simplify with Microsoft Office Excel 2007. High correlating of tomato growth to salinity change and organic fertilizers decompose so that can know the effectiveness and efficiency of their choice.

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RESULTS AND DISCUSSION

Soil organic-C (SOC) conten in Rungkut, Buduran, and Sedati saline soil difeerent after gypsum and organic fertilizers application, presented in Figure 1. SOC content of soil saline Buduran higher than others. While soil Ec and pH value changes after treatment are presented in Figure 2. In Figure 2 appears that the pH of soil saline Rungkut higher when compared with that is in Sedati Buduran. Provision of organic fertilizer from a complete mixture of organic material (OF1), BOF3 and SOF3 makes the value of soil EC is lower than others, respectively 1.13, 0.79, and 0.79 mS / cm. According to Cardon (994) value of soil EC has no effect on growth and crop production. If the EC value> 2 mmhos / cm, then some of the plants will be stunted. Decomposition rate of organic fertilizer in the soil will dissolve the salts of land led to an increase in soil solution electrolyte. Gypsum and organic fertilizers, it should be able to exchange Na for more, but because due process of decomposition of 1-month lead mineralization Na decreased less than perfect so unreal.

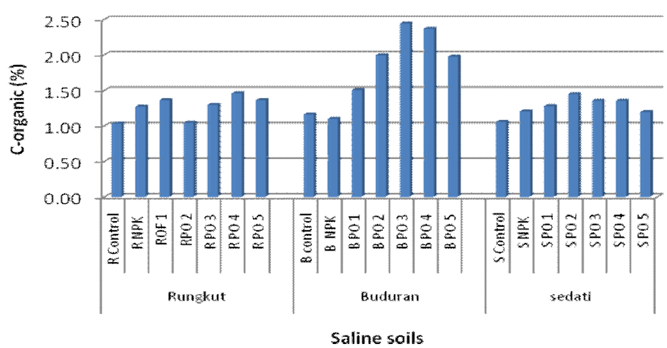

Figure 1. Effect of organic fertilizer application to soil C-organic at various saline soil

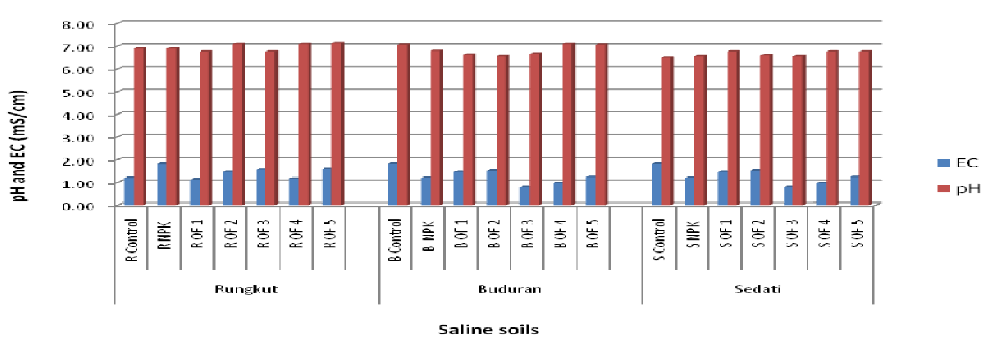

Figure 2. Effect of application organic fertilizer to soil -EC and ï pH at various saline soil

The pattern of changes in levels of soil exchangeable- Na and -K after organic fertilizer treatments are presented in Figure 4. Soil exchangeable-K value is higher than Exchangeable -Na in all areas tested. Rungkut Saline soil which was given a complete organic fertilizer makes exchangeable-Na lowest compared to others because of a complete fertilizer (Ma: C: Cs: Sd: J: G: Mu) will be able to withstand the movement of Na, and increased salt to the rootzone through capillarity is also low. Exchangeable -Na in the control and NPK treatment on Rungkut showed the highest value because of the absence of organic material so that the levels of Exchangeable -Na up. Exchangeable -Na in Buduran lowest which that treatment in OF5, ie. 0.29 me/100g, compared to controls, amounting to 0.94 g me/100 resulting from the effect of giving that is able to suppress the Na in the soil. Exchangeable-Na Sedati lowest in the treatment of OF3 (0.32 me/100g), compared to control and NPK (0.83 me/100 g and 0.78 me/100 g).

The average yield of organic fertilizer treatments soil CEC can be seen in Figure 4. soil CEC values in Buduran were lower than CEC's Rungkut and Sedati. The addition of organic material needed for leaching and increase in soil CEC. Influence of organic fertilizer enhance CEC was treated in R OF5 (55.31 me/100 g manure, compost leaves and cotton seeds). Provision of organic fertilizers, especially manure and straw yield is higher than with other fertilizers. Fertilizer that has undergone decomposition is able to provide and balance of nutrients, become available and improve the cations exchange. The content of N, P and K remaining the most widely found in saline soil mineralized Buduran caused her not perfectly so that the remaining elements in the soil sorption complex. This condition is greatly influenced by the texture of sandy soil which slows down the process of mineralization. Value content of N, P and K are the lowest in the control treatments and NPK fertilizer because the nutrients are rapidly mineralized and available for plants. Overall, K- uptake was higher than N- and P- uptake by tomat after 35 DAP . Application on organic fertilizer enhance NPK ï uptake than control. Between in three saline soil, these uptake not different. Compared to organic fertilizer treatments, NPK (150-300-50) fertilizer treatment made more effect than organic fertilizer application, especially to K-uptake in saline soil Rungkut. While in saline soil Buduran on application of OF 1, and Sedati on OF2 and OF5. For soil saline Sedati, all fertilizer treatments was sufficient, even exceeding levels of NPK fertilizer treatment. Application of OF 2, soil P levels increase beyond P fertilizer was almost 4-fold, P is due to the contribution of the organic material is available is quite high.

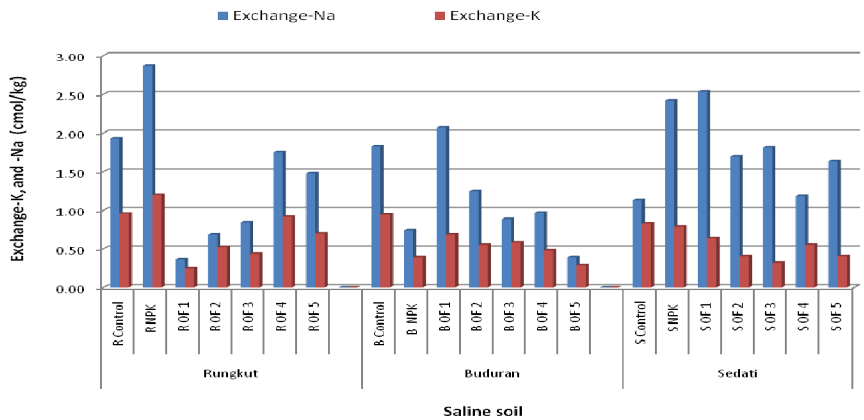

Figure 3. Effect of organic fertilizer application to soil K, Na, and CEC C-organic at various saline soil .

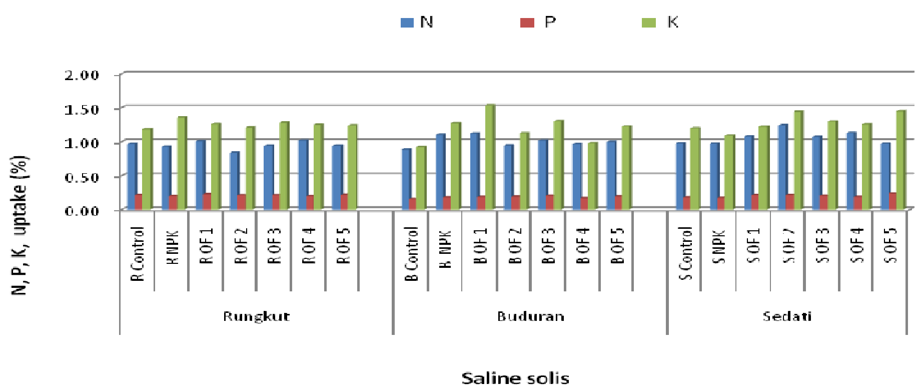

Figure 4. Effect of organic fertilizer application to plant uptake of N, P, and K at various saline soil

The decomposition rate of organic matter in clay-textured soil make of exchangable -Na high. Figure 2 shows that the rate of decomposition of organic material in saline soil Rungkut origin, cause the value of EC was higher when compared with saline soil and Sedati Buduran origin. This happens because the system due to high soil capillarity, causing poor irrigation and that salt leaching inhibited. Or maybe due to the soil column leaching media less, due to the EC has not gone down further. The highest EC values in the control and NPK treatments, so that remain salinity in the soil also increases. This shows without causing soil organic matter increased levels of salt.

Levels of SOC (soil organic- C) in Buduran high, probably due to the high weathering process caused by oxidative soil conditions, sandy texture during the

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incubation period. Medium textured soil Rungkut Sedati and clay, so the slow decomposition process. Salin soil Buduran that given OF3, making C-Organic content highest of 2.44% and lowest in the NPK treatment ie 1.10%. If the soil were given only inorganic fertilizers, the organic-C values decline followed a fairly large and likewise control. The high OH-suspected presence of soluble salts left in up ground, especially cause the pH value rises. This is also related to soil texture as the region contains many Sedati Rungkut and clay so the ability to absorb more cations resulting in high pH changes. The highest pH value in the treatment R-OF5 and the lowest in the treatment R-OF1 and R-OF3. For Buduran Region, the highest pH value and the lowest in salin soil Buduran with OF_4 and OF_2 while for Sedati no change because of highly influenced by soil texture. Soil pH value is also affected by the provision of Gypsum (CaSO4), can sometimes increase or decrese depending on the source material. If the proportion of SO_4^{2-}> Ca^{2+} so that the contribution of H +> OH-in the soil, making the soil pH down.

The average of exchangebale-K from saline soil Sedati highest (1.77 me/100 g) than that was from Buduran (1.16 me/100 g). It is suspected that the presence of the capillarity carrying salts such as Na and above and replaced by K, an exchange of the lead soil-K although there are small because K is on saline soil is also small so that its influence on that was soil-K is not real. Washing transporting cations base out of the zone roots also affect the status of K soil, cations are much leached was Ca^{2+} followed by Na^{+} and Mg^{2+} while K^{+} at least, the content of exchangeable -Ca and -Na high causing soil -K less available . In addition to leaching factor is the region where the soil texture and Sedati Rungkut contains clay so the ability to bind K higher when compared with Buduran.

Organic fertilizers also affects the soil content of potassium. Potassium-bound continuous part will be released into the form can be exchanged and subsequently in the soil solution. Therefore, Ca ions is more easily replaced by K^{+} as well as Al^{+3}, consequently if the sorption complex contains more Ca will more likely fix K, so exchangeable -K will be reduced in the soil. This condition can occur in soil with high Ca content.

CONCLUSION

The extent of organic matter mineralisation depend on textural and salinity. The higher of organic fertilizer grade is not always effective as the controlling salinity. Type of organic fertilizer is the most efficient and effective as soil salinity control varies between different soil salinity, and texture. Giving Organic Fertilizer can increase CEC, availability of N, inhibits N-ammonium volatilization, lowering the EC, but the pH was increased. Clay textured soils (Rungkut and Sedati) causes slow decomposition rate than sandy soil (Buduran).

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